(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
21 June 2001 (21.06.2001)

PCT

(10) International Publication Number
WO 01/43630 A3

(51) International Patent Classification[7]: A61B 5/05

(21) International Application Number: PCT/IL00/00839

(22) International Filing Date:
14 December 2000 (14.12.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/460,699 14 December 1999 (14.12.1999) US

(63) Related by continuation (CON) or continuation-in-part (CIP) to earlier application:
US 09/460,699 (CIP)
Filed on 14 December 1999 (14.12.1999)

(71) Applicant *(for all designated States except US)*: **TRANSSCAN MEDICAL LTD.** [IL/IL]; P.O. Box 786, 10550 Migdal Haemek (IL).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **NACHALIEL, Ehud** [IL/IL]; Mitzpeh Netopha, 15295 Lower Galilee (IL). **ORI, Amos** [IL/IL]; Mitzpeh Netopha, 15295 Lower Galilee (IL). **SAAD, Abraham** [IL/IL]; 122 Hagalil Street, 32683 Haifa (IL).

(74) Agents: **FENSTER, Paul** et al.; Fenster And Company Patent Attorneys Ltd., P.O. Box 10256, 49002 Petach Tikva (IL).

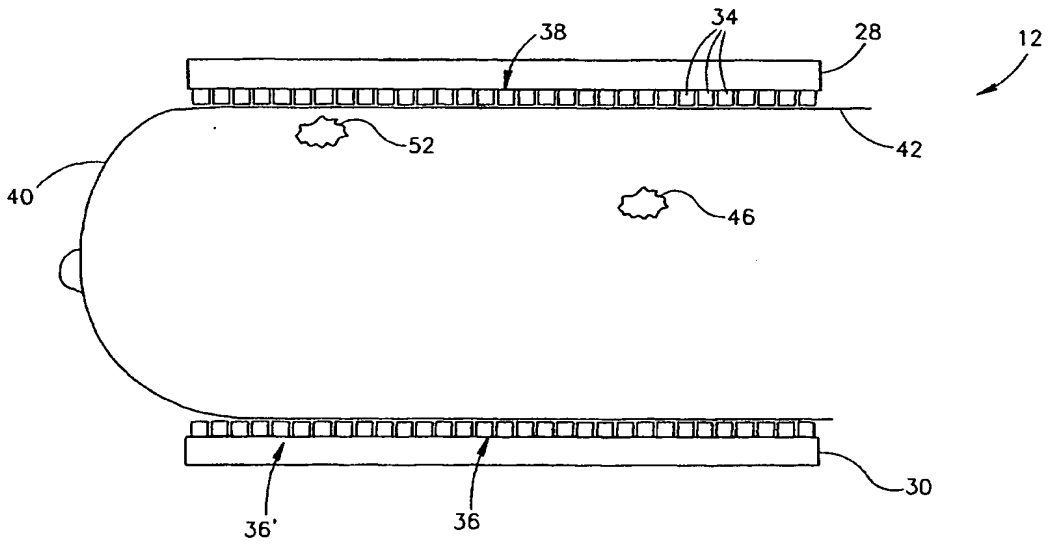
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

[Continued on next page]

(54) Title: LOCALIZATION OF ANOMALIES AND GUIDANCE OF INVASIVE TOOLS BY IMPEDANCE IMAGING



(57) Abstract: Apparatus for impedance imaging of a region within a subject. The apparatus includes a plurality of electrodes adapted to, substantially concurrently, apply electrical signals having a common frequency and different phases to the subject and a plurality of sensing elements adapted to sense electrical signals from a surface of the region, responsive to signals applied from the electrodes.

WO 01/43630 A3

(88) Date of publication of the international search report:
24 January 2002

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/IL 00/00839

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61B5/05

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61B G01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, INSPEC, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 138 148 A (SMITH DENIS NIGEL) 17 October 1984 (1984-10-17)	1-4,6,7, 9,10,13, 14,36, 37, 39-43, 52,53, 81, 84-87, 89,91
A	page 3, line 20 - line 39 page 4, line 11 - line 24 page 4, line 65 -page 5, line 13 page 5, line 28 - line 33	8,15,38, 45,46, 51,64, 67,82, 83, 88-90,98

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 July 2001	30.07.01

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Knüpling, M

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/IL 00/00839

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 272 624 A (GISSER DAVID G ET AL) 21 December 1993 (1993-12-21) column 4, line 42 - line 49 column 6, line 26 - line 31	1-4,6,7, 9,10, 36-39, 52,53,81
A	column 8, line 22 - line 40	8,14,15, 40-43, 45,46, 49,51, 64,67, 82-91,98
X	WO 99 48422 A (SCHOLZ BERNHARD ;SIEMENS AG (DE)) 30 September 1999 (1999-09-30) page 12, line 22 -page 14, line 33	1-4, 6-11,14, 36
A		12,15, 37, 40-43, 45,46, 49, 51-53, 64,67, 81-88, 90,91,98
X	US 5 810 742 A (PEARLMAN ANDREW L) 22 September 1998 (1998-09-22) cited in the application column 18, line 57 -column 19, line 8	1-11,13, 52,53
A	column 19, line 31 - line 37 column 20, line 59 -column 21, line 2 column 30, line 8 - line 11	12.15, 36-43, 45.46, 64.67, 81-91,98
X	RIGAUD B ET AL: "EXPERIMENTAL ACQUISITION SYSTEM FOR IMPEDANCE TOMOGRAPHY WITH ACTIVE ELECTRODE APPROACH" MEDICAL AND BIOLOGICAL ENGINEERING AND COMPUTING,GB,PETER PEREGRINUS LTD. STEVENAGE, vol. 31, no. 6, 1 November 1993 (1993-11-01), pages 593-599, XP000415771 ISSN: 0140-0118	1,6-10, 36. 40-44, 84.91
A	section "Introduction"	15.46, 52.64, 67.81, 82. 85-90.98

-/--

INTERNATIONAL SEARCH REPORT

International Application No
PCT/IL 00/00839

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KOTRE C J: "SUBSURFACE ELECTRICAL IMPEDANCE IMAGING USING ORTHOGONAL LINEAR ELECTRODE ARRAYS" IEE PROCEEDINGS: SCIENCE, MEASUREMENT AND TECHNOLOGY,IEE, STEVENAGE, HERTS,GB, vol. 143, no. 1, 16 January 1996 (1996-01-16), pages 41-46, XP006006750 ISSN: 1350-2344	1-4, 6-11, 13-15, 17,19, 21, 23-28, 40,41, 67-73,91
A	page 42, left-hand column, line 1 - 31 page 42, right-hand column, line 36 - 50	16,18, 20,22, 31-36, 42,45, 46,52, 64, 74-77, 81, 84-88,98
X	GB 2 273 987 A (BRITISH TECH GROUP) 6 July 1994 (1994-07-06)	1-4, 6-11,13, 36,40, 41,64, 91,98, 105
A	page 1, line 21 -page 2, line 1 page 8, line 11 - line 21	15, 37-39, 42-46, 52, 65-67, 81,84, 99-104, 106-109
X	ANAH J ET AL: "Multi-function interface unit for applied potential tomography" PROCEEDINGS OF THE ANNUAL INTERNATIONAL CONFERENCE OF THE IEEE ENGINEERING IN MEDICINE AND BIOLOGY SOCIETY (IEEE CAT. NO.88CH2566-8), NEW ORLEANS, LA, USA, 4-7 NOV. 1988, 1988, pages 287-288 vol.1, XP002171794 New York, NY, USA, IEEE, USA	1-10,13, 14,36, 40-44, 46,52, 53,84,91
A	page 287, left-hand column, line 12 - 38 page 288, sections 2 "The preamplifier" and 3 "The capacitance compensation circuit"	15,45, 47-49, 51,64, 67,81
A	WO 93 23112 A (SCHOUENBORG JENS) 25 November 1993 (1993-11-25) page 7, line 15 - line 25	50,54

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IL 00/00839

Box I Observations where certain claims wer found unsearchabl (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. [X] Claims Nos.: 110-115
because they relate to subject matter not required to be searched by this Authority, namely:

Rule 39.1(iv) PCT - Method for treatment of the human or animal body by surgery

2. [ ] Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. [ ] Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. [ ] As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. [ ] As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. [X] As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

1-54,64-91,98-109

4. [ ] No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

[ ] The additional search fees were accompanied by the applicant's protest.

[X] No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-14,36-45,49-54.81,83-91*

Apparatus for impedance imaging comprising controller adapted to initiate sensing while a sensing element is kept floating and method

*Claims 49 and 50 only if dependent on claim 44 or 45

Claim 51 only if dependent on claim 49 and claim 49 dependent on claim 44 or 45

Claim 83 only if dependent on claim 81

2. Claims: 15-35,67-80,82,83*

Apparatus for impedance imaging comprising electrification controller adapted to electrify a long and narrow line of electrifyable elements

*Claim 83 only if dependent on claim 82

3. Claims: 46-51*

Apparatus for sensing electrical signals comprising sensing circuit with controllable input impedance

*Claims 49,50 only if not dependent on claim 44 or 45

Claim 51 only if not dependent on claim 49 and claim 49 dependent on claim 44 or 45

4. Claims: 55-58,92-97

Apparatus for impedance imaging comprising processing unit to determine a depth of an anomaly and method

5. Claims: 59-63,116-127

Apparatus for determining location of an elongate object comprising controller adapted to adjust electrical signals provided to the elongate object

6. Claims: 64-66,98-109

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Apparatus for impedance imaging comprising probe adapted to apply electrifying signals at a plurality of distinct frequencies and method

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/IL 00/00839

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
GB 2138148	A	17-10-1984	US 4649932	A	17-03-1987
US 5272624	A	21-12-1993	NONE		
WO 9948422	A	30-09-1999	DE 19980466	D	22-02-2001
US 5810742	A	22-09-1998	AU 705041	B	13-05-1999
			AU 2591095	A	15-05-1996
			CA 2203405	A	02-05-1996
			CN 1166779	A	03-12-1997
			EP 0788329	A	13-08-1997
			HU 77227	A	02-03-1998
			JP 10512462	T	02-12-1998
			NZ 287251	A	24-09-1998
			WO 9612439	A	02-05-1996
			US 6055452	A	25-04-2000
GB 2273987	A	06-07-1994	DE 69308324	D	03-04-1997
			DE 69308324	T	05-06-1997
			EP 0674772	A	04-10-1995
			WO 9415228	A	07-07-1994
			JP 8504632	T	21-05-1996
			US 5626146	A	06-05-1997
WO 9323112	A	25-11-1993	SE 469465	B	12-07-1993
			AT 141177	T	15-08-1996
			AU 4096193	A	13-12-1993
			CA 2135301	A	25-11-1993
			DE 69304035	D	19-09-1996
			DE 69304035	T	19-12-1996
			EP 0606412	A	20-07-1994
			ES 2090999	T	16-10-1996
			PL 171134	B	28-03-1997
			SE 9201453	A	12-07-1993
			US 5449378	A	12-09-1995